Final Report

The Impact of Forest Service Activities on the Stream Flow Regime in the Platte River

Submitted by

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Executive Summary

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This report addresses an expansion of the earlier effort by Troendle and Nankervis (Estimating Additional Water Yield From Changes in Management of National Forests in the North Platte Basin) to assess the long-term impacts of Forest Service activity in the North Platte River Basin on water yield from the basin. Two primary tasks were associated with the current effort. The first involved developing a protocol for predicting, or modeling, the consequence of present and future Forest Service management activities on water yield from the North Platte Basin The second task involved identifying reference gauging sites (stream flow, precipitation, and snow pack accumulation), in both the North and South Platte River basins, that will be useful in documenting the future effects, if any, of management impacts on measured, or actual, stream flow.

As part of Task 1, the WRENSS Hydrologic model was revised and updated to represent current state of the art understanding of hydrologic response in the Cold Snow Zone of the Central and Northern Rocky Mountains (Appendix A) and programmed in SAS (Appendix B) for use in the Region. This altered the simulation of total stream flow made in the earlier analysis (Troendle and Nankervis 2000) but had only minor impact on the decreases in stream flow that were simulated to have occurred, over time, from 1860 to 1997 as a result of increases in forest density. Current simulations indicate that increases in forest density may have resulted in a decrease in average annual stream flow in the North Platte River of approximately 160,000 acre-feet of water per year. Most of the simulated decrease occurred in the 1860 to 1940 period with modest declines occurring from 1960 to 1997. Projecting the simulations out to 2017 indicate that on average an additional 27,000 acre-feet of water per year can be lost to increases in forest density by the year 2017.

A second aspect of the stream flow simulation effort was to determine the effect that current level of management activity might have on water yield in the North Platte River. Management activities occurred on a total of 4874 acres of the nearly 1.2 million acres of NFS land from 1997 to 2001 impacting an average of 975 acres each year. Based on the changes in vegetation that resulted from those activities, we simulated an average increase in flow of approximately 0.0027 area inches per year, each year, for the 5-year period from 1997 to 2001 may have occurred. Assuming this level of activity is repetitive thru 2017, we simulated that water yield on the North Platte River will be increased an average of approximately 0.05 area inches per year by year 2017, equating to an estimated average annual increase in flow of 4600 acre-feet of water per year in 2017. This simulated increase due to timber harvest is substantially below the average 27,000 acre feet decline projected to occur as a result of forest growth during the same period.

As part of the second Task, 9 reference stream gauging sites were selected and an analytical procedure has developed in an MS EXCEL spreadsheet format that; 1) characterizes the relationship between pre-1997 stream flow and either snow pack accumulation or precipitation at 3 or more nearby sites, 2) allows user input of post-1997 data for stream flow and snow pack or precipitation, and 3) plots and allows comparison of the pre-1997 stream flow relationship with the post 1997 observations. The user can then determine if a covariance analysis is warranted to determine the significance of what might appear to be a post 1997 departure.